REPLY UNDER 37 C.F.R. 1.1116 – EXPEDITED PROCEDURE
TECHNOLOGY CENTER 1793

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Art Unit	: 1793	**Customer No.: 035811**
Examiner	: Jie Yang	
Serial No.	: 10/526,802	
Filed	: March 7, 2005	
Inventors	: Yasuhiro Omori	Docket No.: JFE-05-1039
	: Akihiro Matsuzaki	
Title	: MACHINE STRUCTURAL STEEL	
	: PRODUCT HAVING SUPERIOR	Confirmation No.: 7406
	: FORMABILITY OF ROLL-FORMING,	
	: QUENCHING-CRACK RESISTANCE,	
	: AND TORSIONAL PROPERTIES,	
	: AND DRIVE SHAFT	
		Date: March 10, 2008

RESPONSE

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
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Sir:

This is in response to the Official Action dated December 6, 2007.

Claims 1 to 3 stand rejected under 35 U.S.C. §103(a) as allegedly obvious in view of Matsuzaki, either alone or in view of Isokawa. Matsuzaki teaches a steel for machine structure expressly having less than 0.05% Si content by mass. However, the Official Action alleges that it would be obvious to modify the composition of Matsuzaki to contain more than 0.05% to 0.15% Si as recited in Claim 1 because a content of less than 0.05% Si is just outside of the claimed range. Additionally, the Official Action alleges that it would be obvious to modify the Si content in Matsuzaki in view of the disclosure of a steel composition with 0.15% or less Si content in Isokawa.

The Applicants respectfully submit that Claims 1-3 are not obvious in view of Matsuzaki alone or in view of Isokawa. Matsuzaki explicitly teaches a content of less than 0.05% Si and provides no motivation to modify that amount. Indeed, the Matsuzaki document teaches away from increasing the amount of Si above 0.05% when it states that it should be "decreased by as much as possible." This important teaching may be found in paragraph [0015] of Matsuzaki.

Furthermore, in addition to failing to teach or suggest a composition with a content, by mass, of more than 0.05% to 0.15% Si, Matsuzaki also does not teach the specific recited

amounts of Cr, Cu, and Ni. While Matsuzaki teaches a content, by mass of 0.15% or less Cr, 1.0% or less Cu, and 3.5% or less Ni which overlaps the ranges recited in Claim 1 (0.1 to 0.2% Cr, 0.06-0.25% Cu, and 0.05-0.2% Ni), the differences in the content percentages allow for distinct and inferior compositions because the amounts of these elements are important to achieve desirable properties of the claimed composition.

For example, a steel composition with Si content greater than 0.05% and Cr greater than 0.05%, as recited in the rejected claims, is distinct from the composition with Si content less than or equal to 0.05% and Cr less than or equal to 0.05% taught by Matsuzaki. As illustrated in the Applicants' Fig. 1, where the LD value is 120 or less, a composition with Si>0.05% and Cr>0.05% has improved die life compared to a composition with Si≤0.05% and Cr≤0.05%. Improved die life corresponds to enhanced rotary-forming property which is an important property of steel material for a machine structural steel product.

Furthermore, Si operates as a deoxidation element and strengthens the steel in a ferrite solid solution state. When added in amounts greater than 0.05%, Si improves the torsional properties of the steel. However, Si in amounts exceeding 0.15% deteriorates the machinability of the metal. Matsuzaki does not teach that excessive amounts of Si can deteriorate machinability. Therefore, if one of skill in the art were hypothetically motivated to increase the Si above 0.05%, he or she would have no guidance as to the maximum threshold amount.

Additionally, the claims recite a Cu content of less than 0.25% and a Ni content of less than 0.2% because Cu and Ni are elements that are inevitably incorporated as tramp elements and degrade the formability of rotary forming in amounts exceeding 0.25% and 0.2%, respectively. However, the rejected claims also specify at least 0.06% Cu and at least 0.05% Ni because manufacturing costs are increased when the Cu and Ni content is below the claimed levels.

The Applicants further sought to mitigate the negative effects of tramp elements such as Cu and Ni have on quench-cracking resistance and torsional properties of the steel material and discovered that increasing the Cr content accomplishes this objective. The addition of more than 0.1% Cr to the steel material improves torsion properties, machinability, and form-rolling properties. However, a Cr content of more than 0.2% reverses these benefits. Additionally, increasing the Si content and decreasing the Mn content can overcome the lowering of torsional property and machinability caused by the increase in Cr content.

In contrast to the claimed composition, which is designed to maximize formability of rotary forming while minimizing cost, Matsuzaki teaches 1.0% or less Cu and 3.5% or less Ni, which included ranges that do not accommodate the needs of formability and reduced cost. Matsuzaki also teaches a Mn content of 0.67 to 1.7%, which falls on the upper range and exceeds the maximum Mn content of 1.1% recited in the claims.

Because the constituent elements of the composition are important for bringing about the enhanced properties of the claimed composition, and Matsuzaki fails to teach the claimed percent content, the Applicants respectfully submit that the claims are not obvious in view of Matsuzaki. Indeed, Matsuzaki fails to recognize how the specific proportions of the elemental content of the steel product affect the properties of the product and identifies content percentages that would result in inferior products. Therefore, one skilled in the art in view of Matsuzaki would not be guided to make the machine structural steel product provided with superior formability of rotary-forming, quenching-crack resistance, and torsional properties recited in Claims 1-3.

Furthermore, the Applicants respectfully submit that Claims 1-3 are also not obvious over Matsuzaki in further view of Isokawa. The Official Action alleges that the claimed steel product is obvious because one skilled in the art would modify the steel product of Matsuzaki to have the Si content taught by Isokawa.

The Applicants respectfully submit that, even if one skilled in the art were motivated to combine the teachings of Isokawa and Matsuzaki, the resulting composition would be distinct from the claimed steel product. Isokawa does not disclose a steel product with a texture of more than 5 to 30% bainite phase and comprising more than 0.05 to 0.15% Si, 0.05 to 0.5% Mo, 0.01 to 0.05% Ti, and 0.0005% to 0.0050% B, as recited in Claim 1.

First, Isokawa teaches in col. 3, lines 18-25 that a steel product containing more than 5% bainite phase is so hard that the "cuttability is lowered and the life of the mold used is shortened during roll finishing," particularly when the hardness is higher than 90 HRB. Isokawa discloses only one steel product with a texture of more than 5 to 30% bainite phase. Isokawa deems that steel to be inferior because it has a hardness of 94 HRB. (See, Control 2 in Tables 1 and 2 of Isokawa.) Accordingly, one skilled in the art in view of Isokawa would be led away from the steel product with a texture more than 5 to 30% bainite because Isokawa explicitly states that such a product is inferior and unsuitable because of excessive hardness.

Secondly, if one of skill in the art were to look to Isokawa to make the claimed steel product, in spite of Isokawa's disparagement of a steel composition with a bainite phase of 5% to 30%, he or she would be taught to create a different and inferior product. One of skill in the art would be guided by the percent elemental contents disclosed for Control 2, which are 0.27% Si, only 0.02% Mo, and no Ti or B.

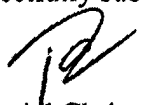
As discussed above, the machinability of the steel product deteriorates Si content of more than 0.15% and the 0.27% content of Control 2 is well over this threshold. Therefore, not only would one of skill in the art be taught to use a Si content not contained in the claimed range, the resulting product would also have inferior machinability.

Additionally, the Mo content of 0.05% recited in the claims is an effective amount to improve hardenability and growth of bainite to increase machinability, and the steel product disclosed in Isokawa contains only 0.02% Mo. Control 2 of Isokawa, unlike the claimed steel product, also entirely lacks Ti and B. Ti improves fatigue strength by forming a nitride with N and reducing the grain size of austenite in high-temperature heating. Furthermore, Ti is essential for ensuring that B dissolves, which improves hardenability and torsional strength.

Because the steel product disclosed in Isokawa does not contain the proper amounts of these advantageous elements, it would reasonably be expected to be inferior with respect to machinability, fatigue strength, hardenability, and torsional strength. Therefore, the Applicants respectfully submit that one skilled in the art in view of Matsuzaki and Isokawa would not be guided to make the machine structural steel product provided with superior formability of rotary-forming, quenching-crack resistance, and torsional properties recited in Claims 1-3. Withdrawal of the rejection over these documents is respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire Application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,



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